Suisun Marsh Levee Breaches: Disaster or Opportunity?

IEP & BDMF Joint Session

March 1, 2000

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DWR

The Answer Is:

- "Maintained" (small) levee breaches in the Suisun Marsh can reduce salinity in the Delta.
  → Opportunity for restoration win-win...

- "Unrepaired" (large) levee breaches in the Suisun Marsh can increase salinity in the Delta.
  → A potential disaster...

Suisun Marsh Levee Breach Modeling

1. Lessons from modeling the February 1998 Suisun Marsh flood.

2. CALFED Suisun Marsh Levee Investigation Team Modeling.

3. How does that happen? (Mechanisms)

4. Questions for Biologists.

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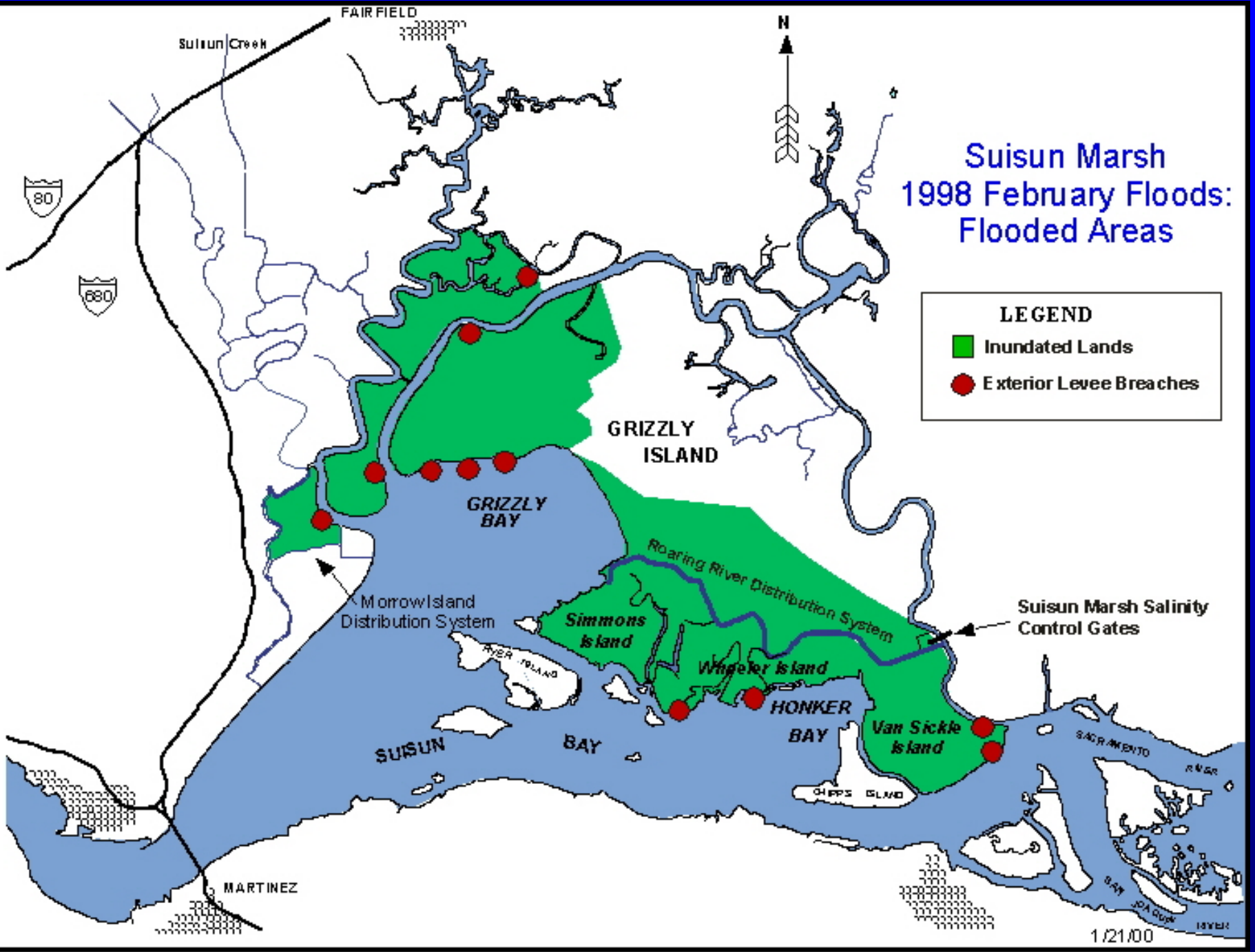
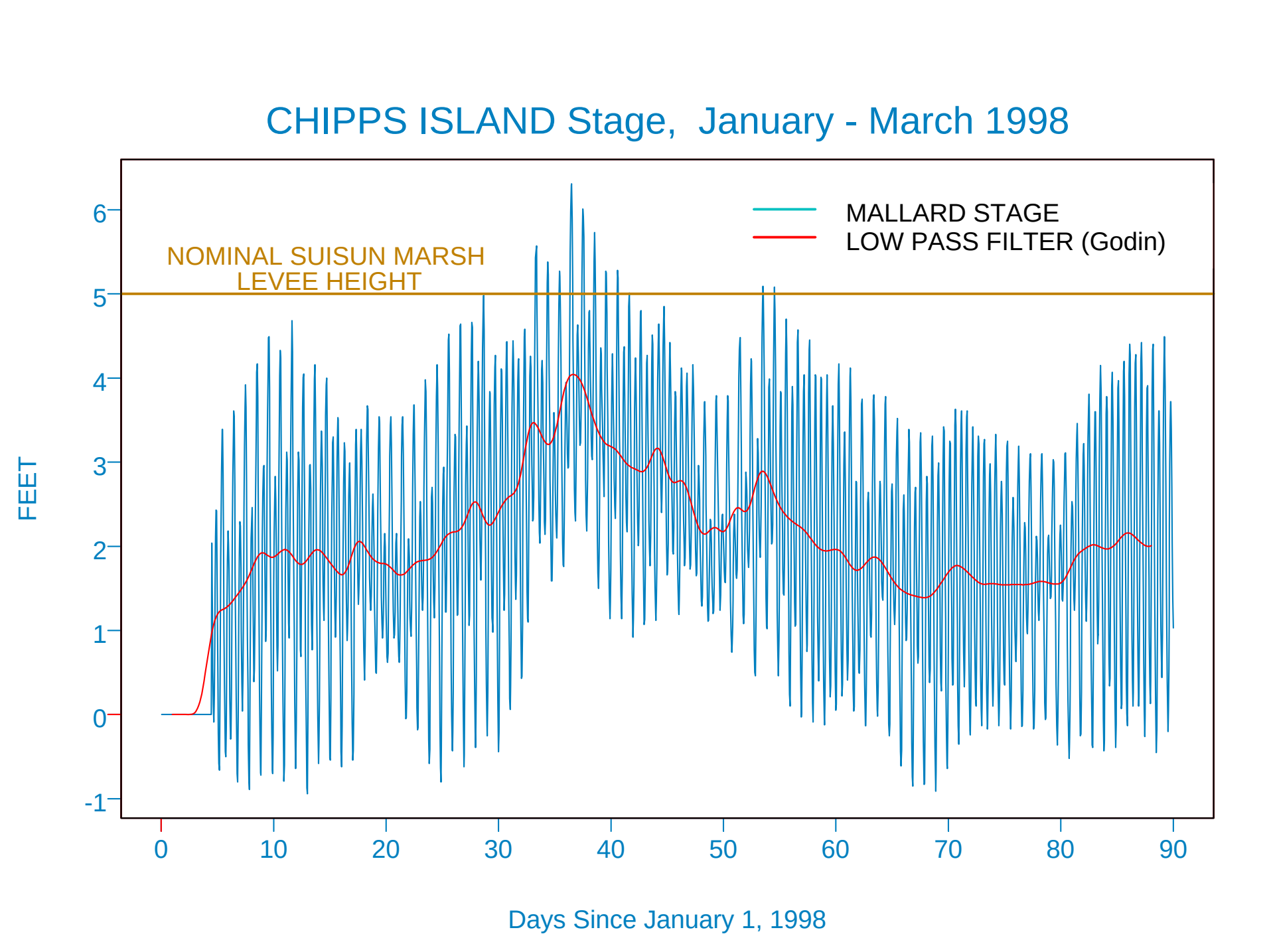

Suisun Marsh
1998 February Floods:
Flooded Areas
LEGEND
Inundated Lands
Exterior Levee Breaches
N
FAIRFIELD
Suisun Creek
80
680
GRIZZLY ISLAND
GRIZZLY BAY
Morrow Island Distribution System
Roaring River Distribution System
Simmons Island
Wheeler Island
HONKER BAY
Van Sickle Island
Suisun Marsh Salinity Control Gates
SUISUN BAY
MARTINEZ
1/21/00


CHIPPS ISLAND Stage, January - March 1998
MALLARD STAGE
LOW PASS FILTER (Godin)
NOMINAL SUISUN MARSH
LEVEE HEIGHT
FEET
6
5
4
3
2
1
0
-1
0
10
20
30
40
50
60
70
80
90
Days Since January 1, 1998

February 1998
Van Sickle Island
looking across to Pittsburg

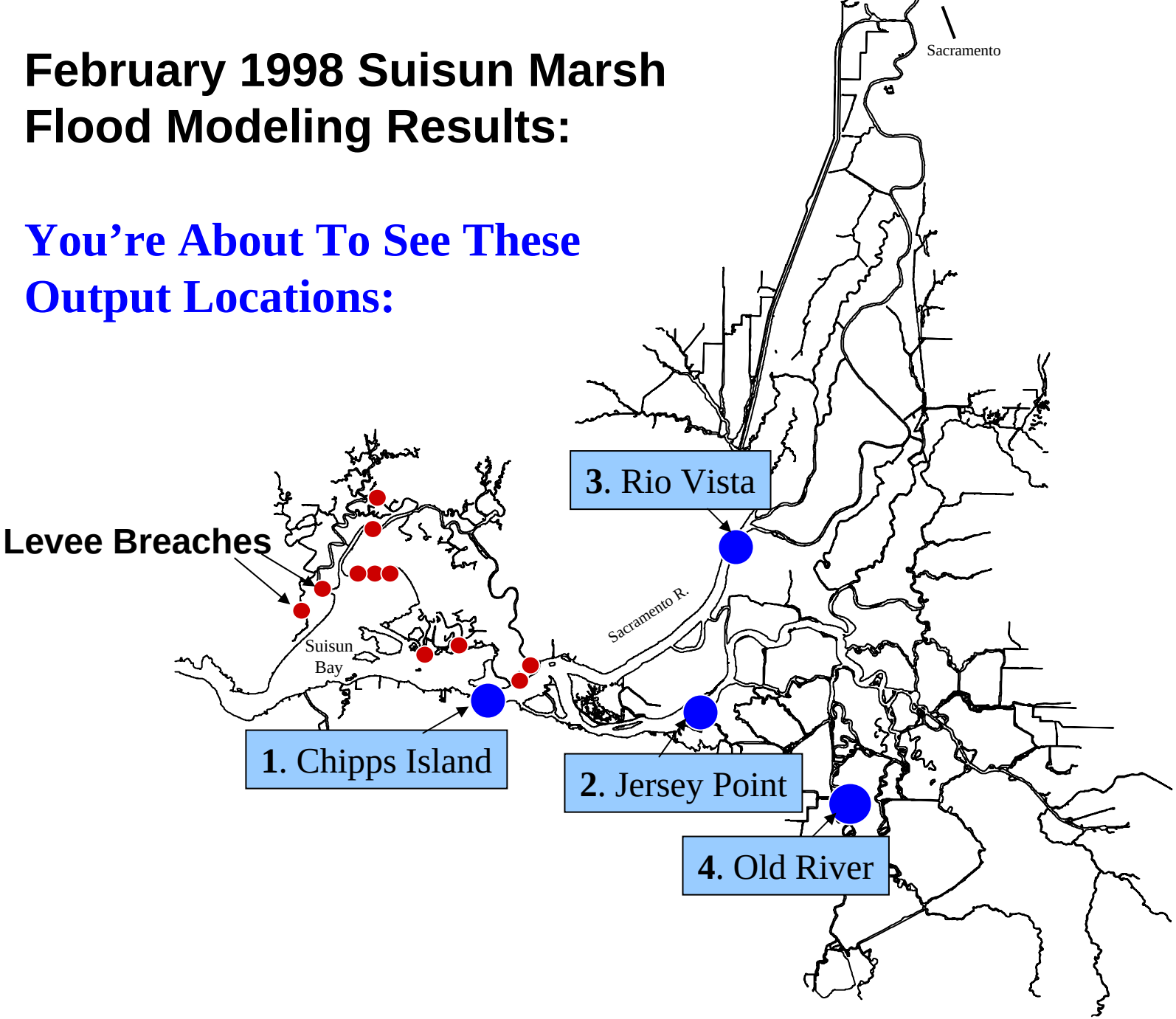
1998 Suisun Marsh Flood Modeling Approach

- Simulate Historical 1991-1992 drought hydrology (Base Case).

- 2 scenarios:
  1. February 1998 flood (eleven, **100' wide** breaches).
  2. Eleven **really big** ("unrepaired") breaches (>20% of Suisun Bay perimeter).

February 1998 Suisun Marsh Flood Modeling Results:

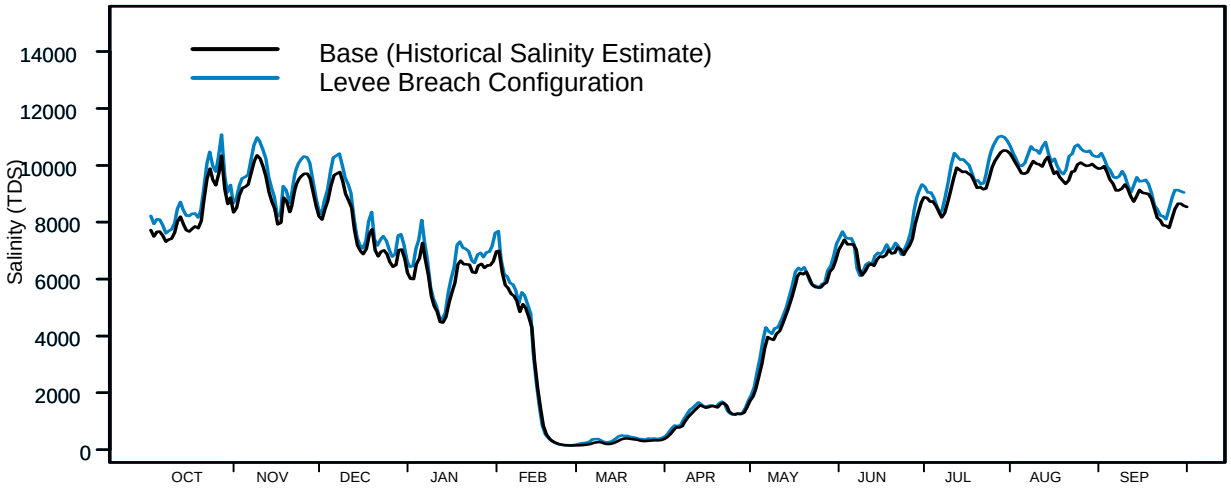
You're About To See These Output Locations:



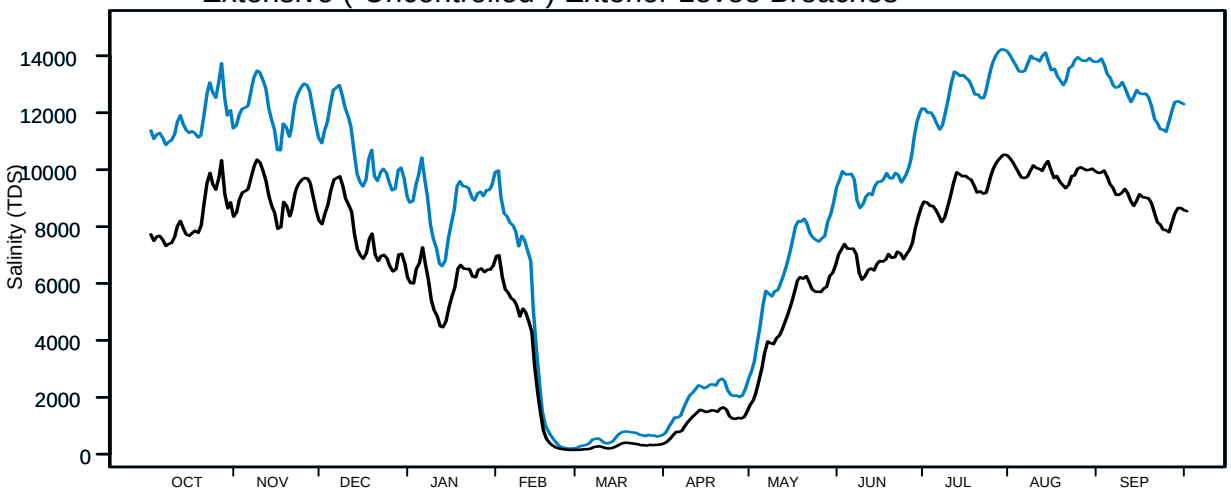
CHIPPS ISLAND 1992

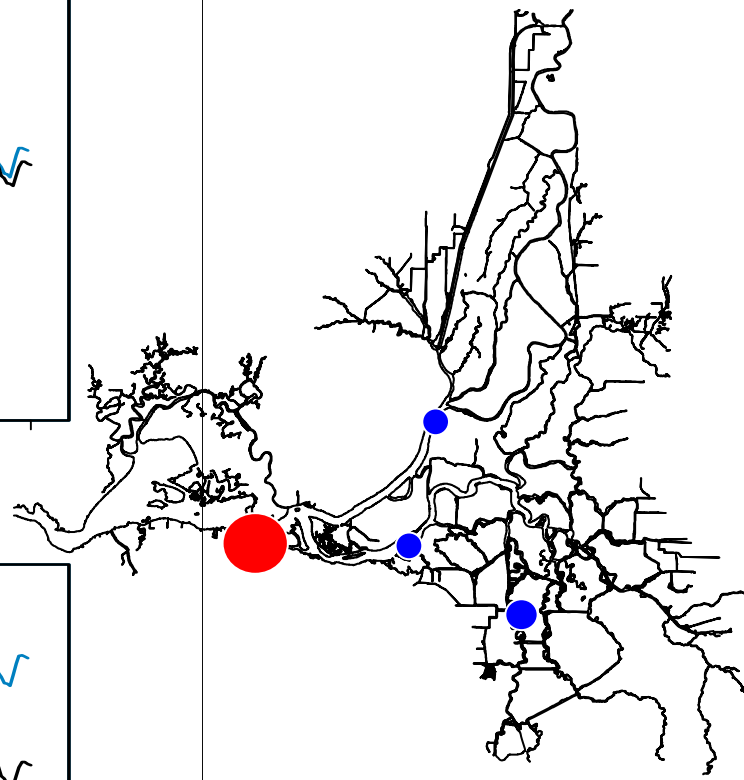
Impact of February 1998 Suisun Marsh Levee Breaches 1/

Eleven 100' Exterior Levee Breaches



Extensive ("Uncontrolled") Exterior Levee Breaches





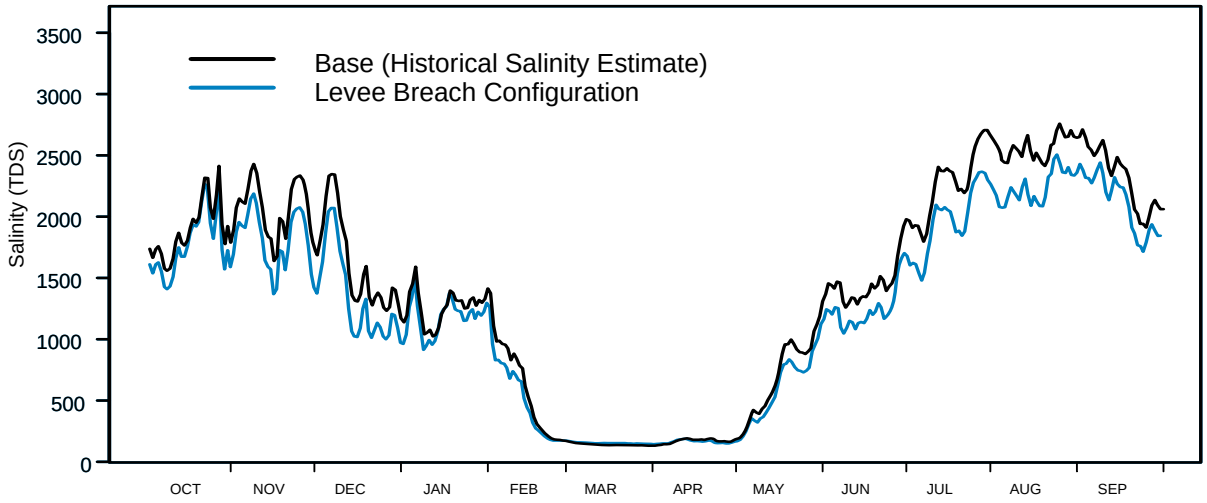
1/ DWRDSM1 Suisun Marsh Version
Levee Breaches initiated on October 1, 1990
Suisun Marsh Planning (DRAFT)

Thu Feb 24 11:49:27 2000

JERSEY POINT 1992

Impact of February 1998 Suisun Marsh Levee Breaches 1/

Eleven 100' Exterior Levee Breaches



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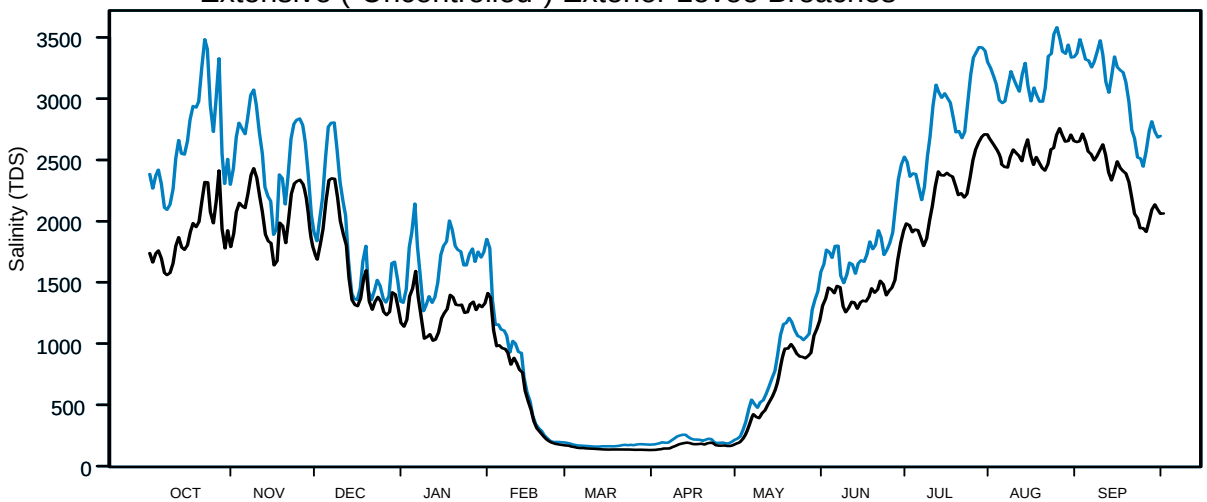

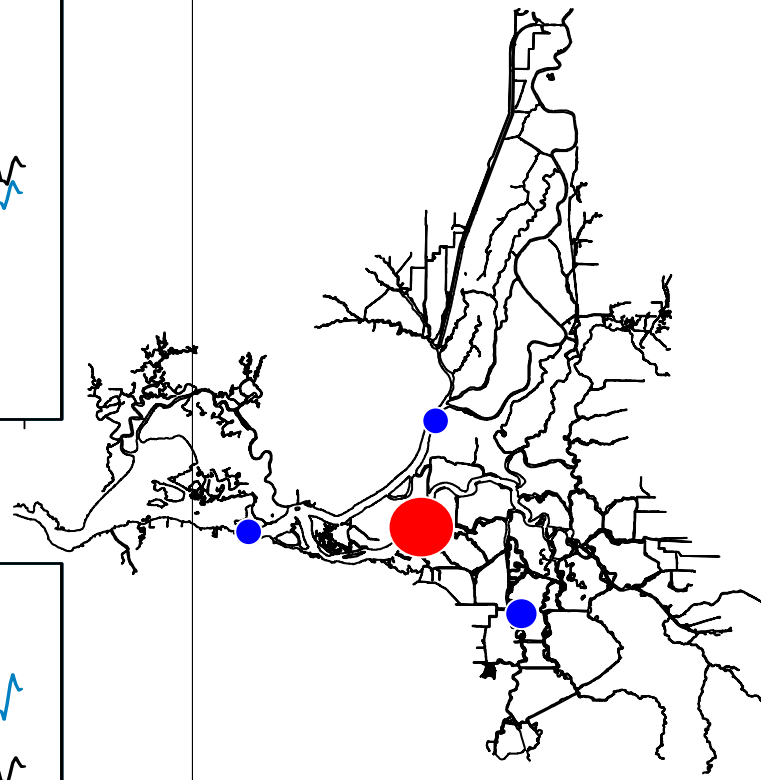

1/ DWRDSM1 Suisun Marsh Version
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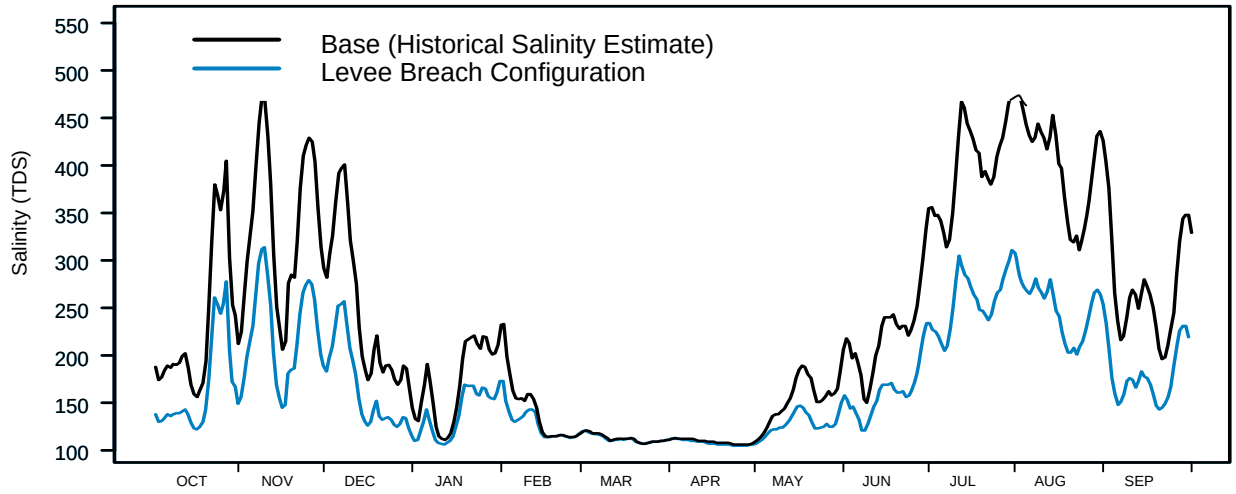
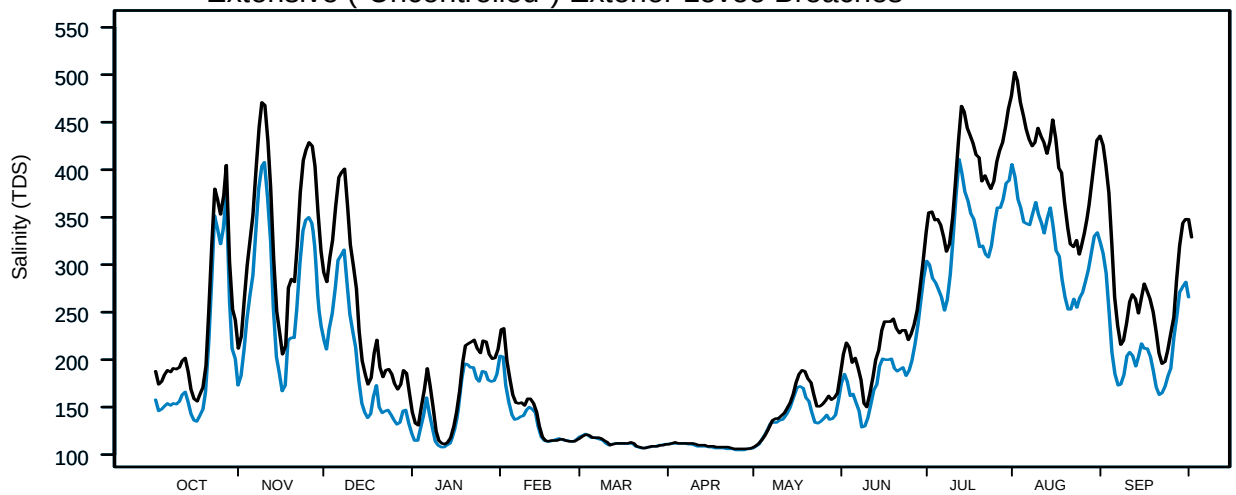
RIO VISTA 1992

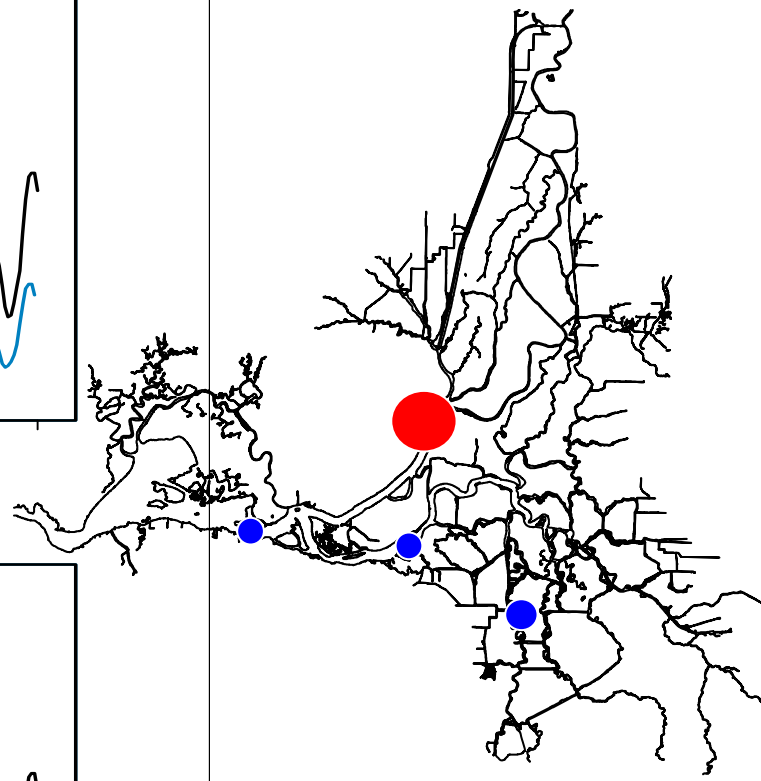
Impact of February 1998 Suisun Marsh Levee Breaches 1/

Eleven 100' Exterior Levee Breaches



Extensive ("Uncontrolled") Exterior Levee Breaches





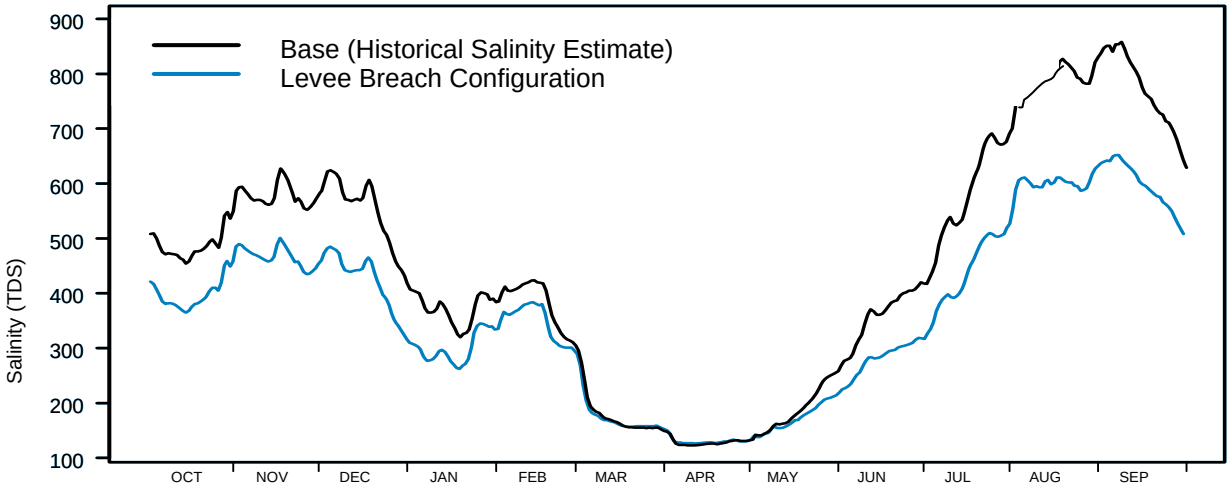
1/ DWRDSM1 Suisun Marsh Version
Levee Breaches initiated on October 1, 1990
Suisun Marsh Planning (DRAFT)

Thu Feb 24 11:49:28 2000

CONTRA COSTA CANAL 1992

Impact of February 1998 Suisun Marsh Levee Breaches 1/

Eleven 100' Exterior Levee Breaches



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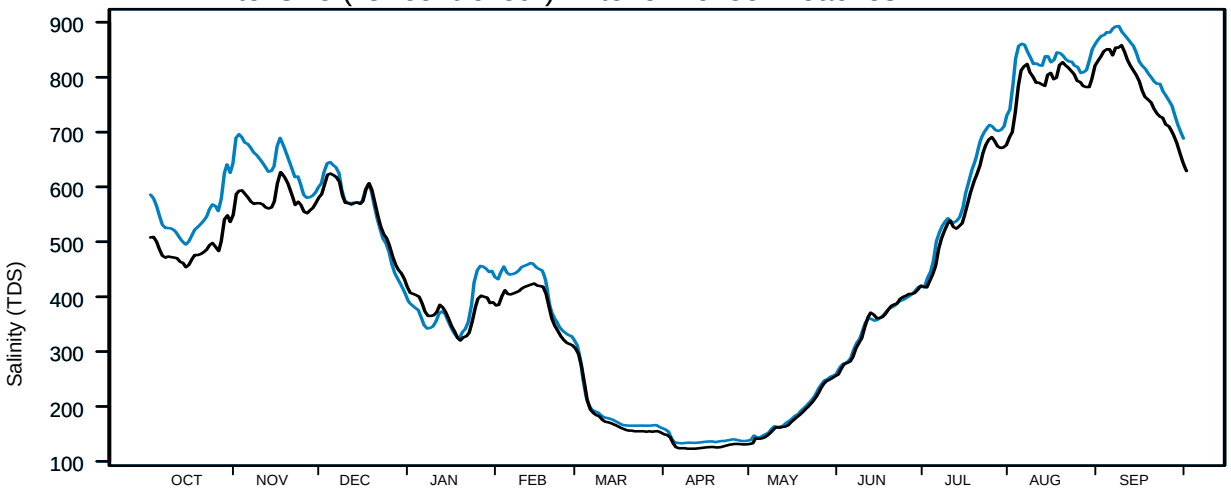

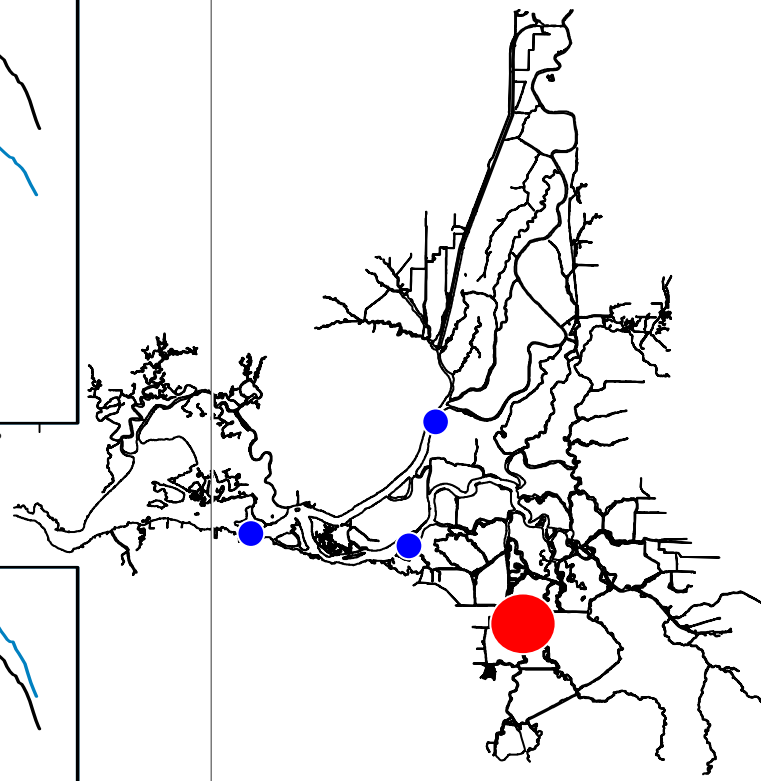

1/ DWRDSM1 Suisun Marsh Version
Levee Breaches initiated on October 1, 1990
Suisun Marsh Planning (DRAFT)

Thu Feb 24 12:26:16 2000

Lessons of 1998 Suisun Marsh Flood

- Suisun Marsh levees are vulnerable and not well maintained.
- Large (“unrepaired”) levee breaches will increase salinity in Suisun Bay and the Delta.
- Small (“maintained”) levee breaches increase local salinity, but decrease Delta salinity.

Suisun Marsh Levee Breach Modeling

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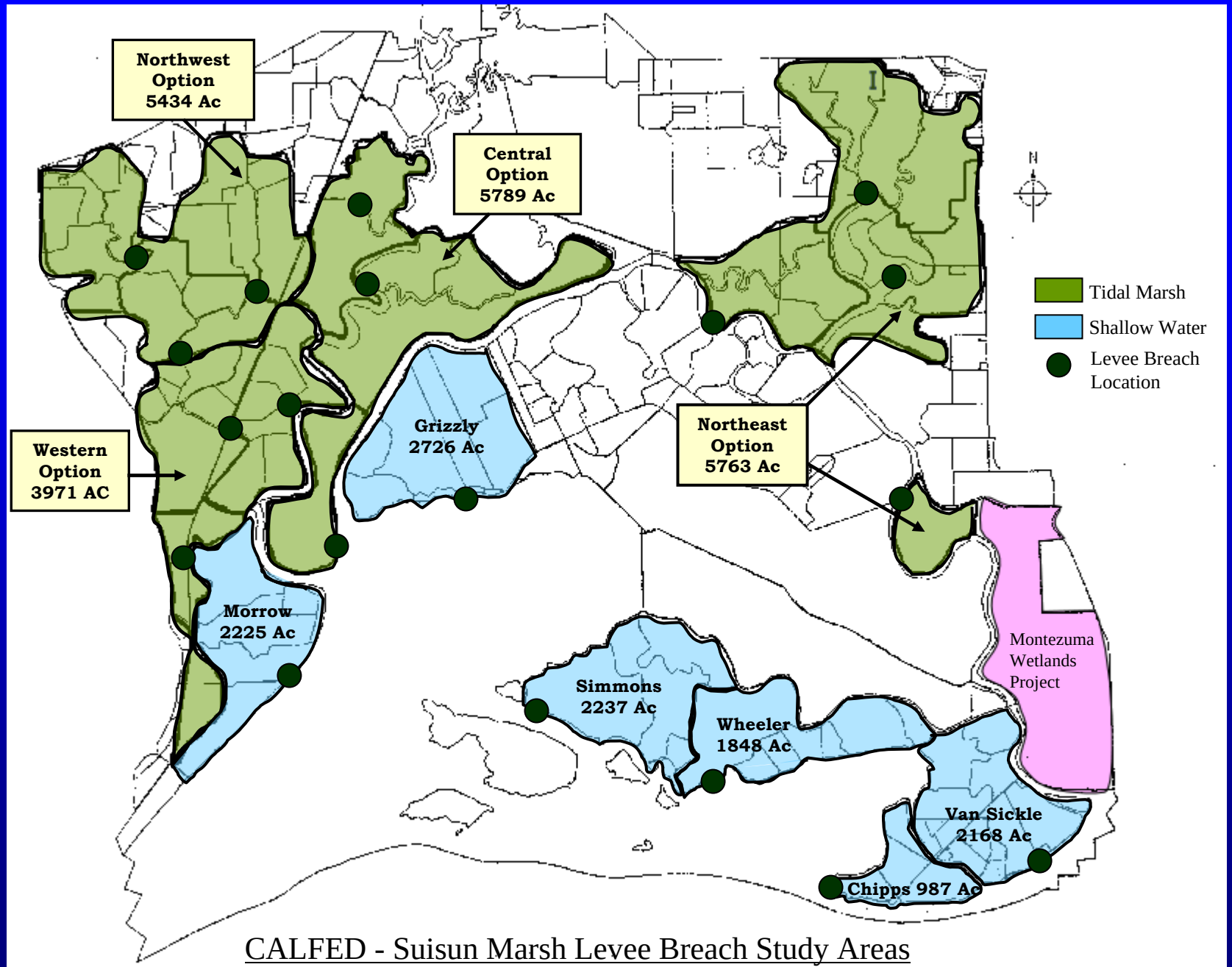
3. How does that happen? (Mechanisms)

4. Questions for Biologists.

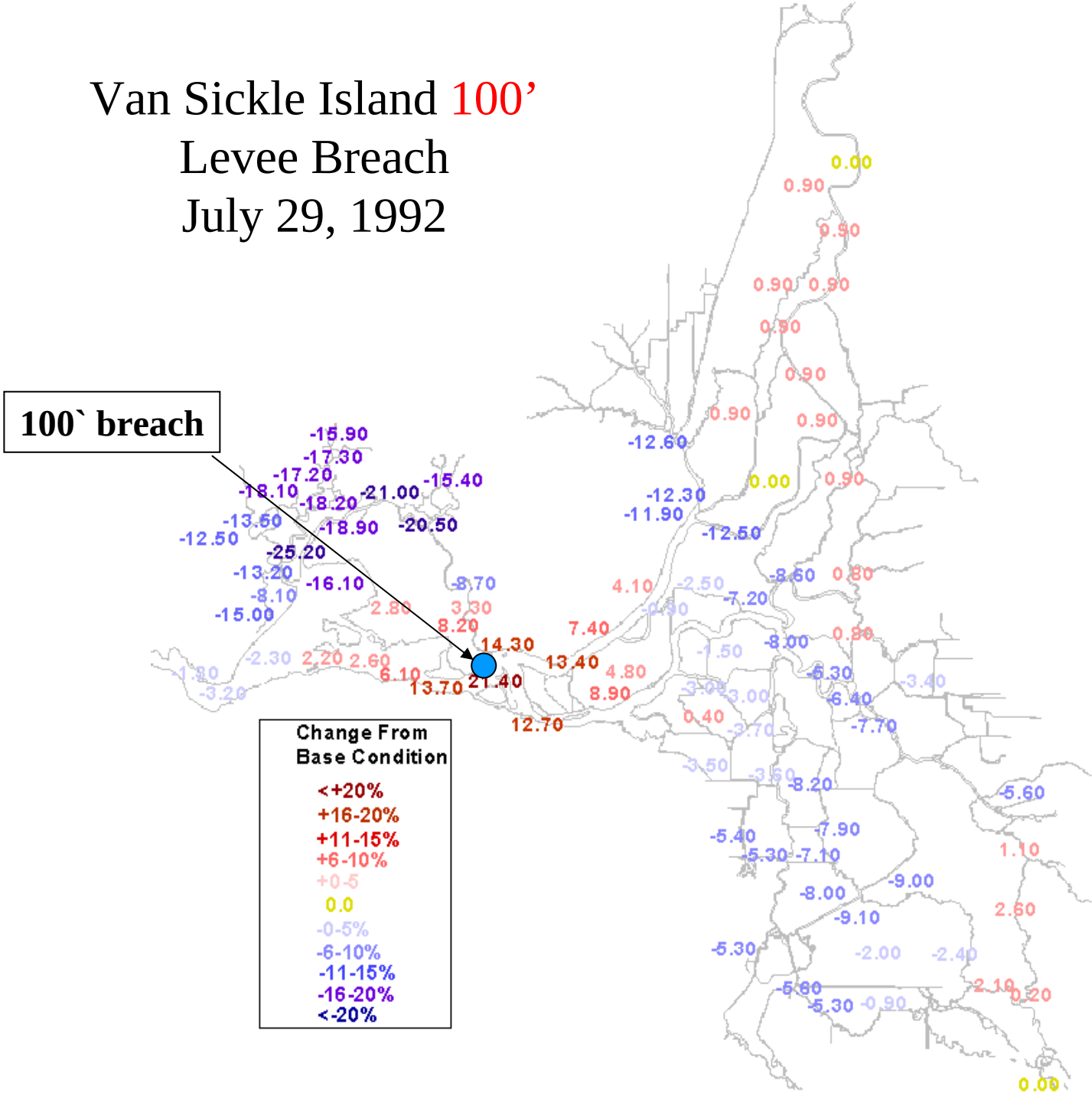
The Charge to the Suisun Marsh Levee Investigation Team from CALFED:

- Should Suisun Marsh Levees be included in the CALFED Levee Program?
- If Suisun Marsh levees are added to the program, are there *opportunities* for water quality improvement and ecosystem restoration?

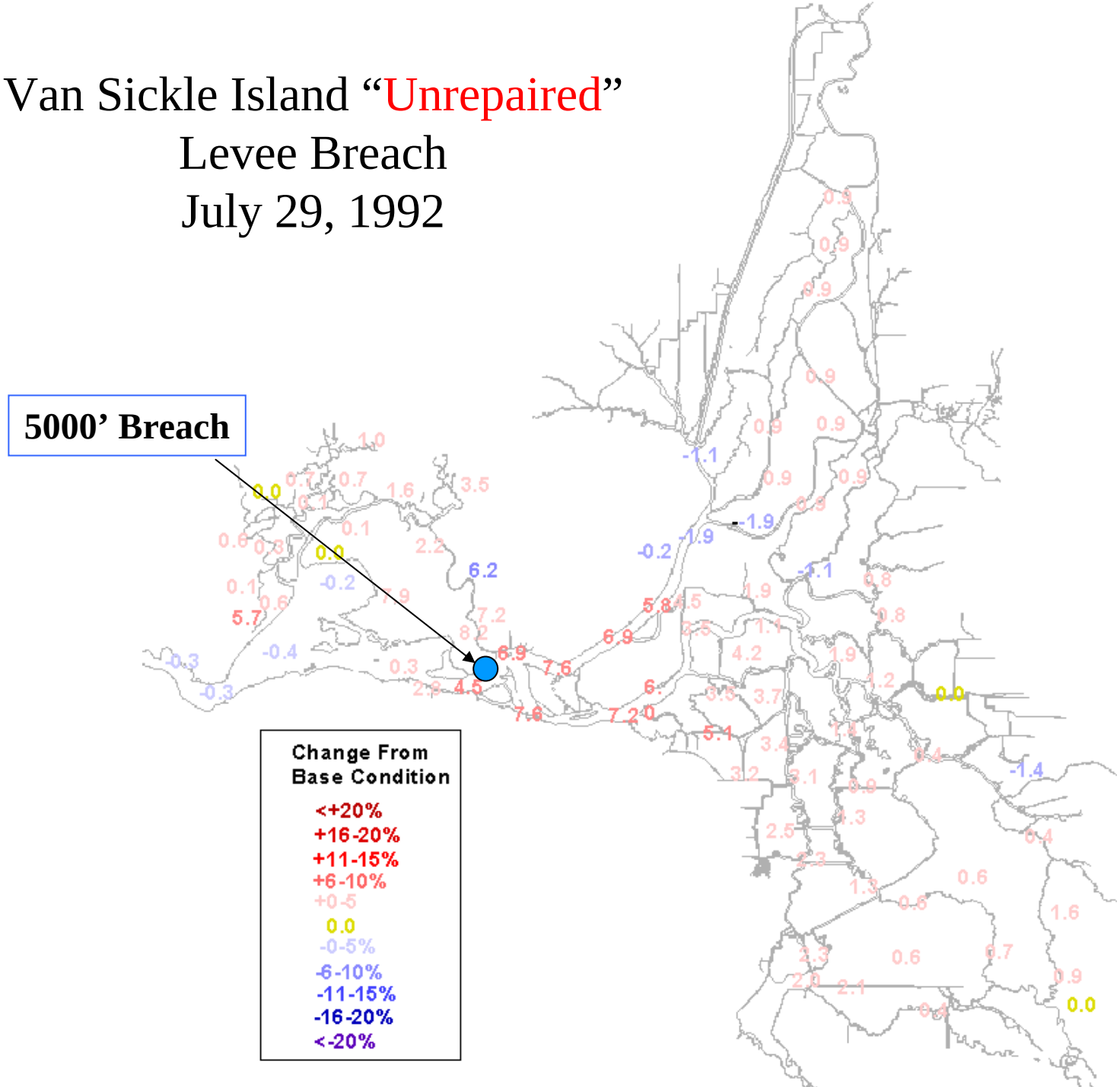


CALFED - Suisun Marsh Levee Breach Study Areas

Van Sickle Island 100’ Levee Breach July 29, 1992



Van Sickle Island "Unrepaired" Levee Breach July 29, 1992



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Two *"competing"* mechanisms are at work:

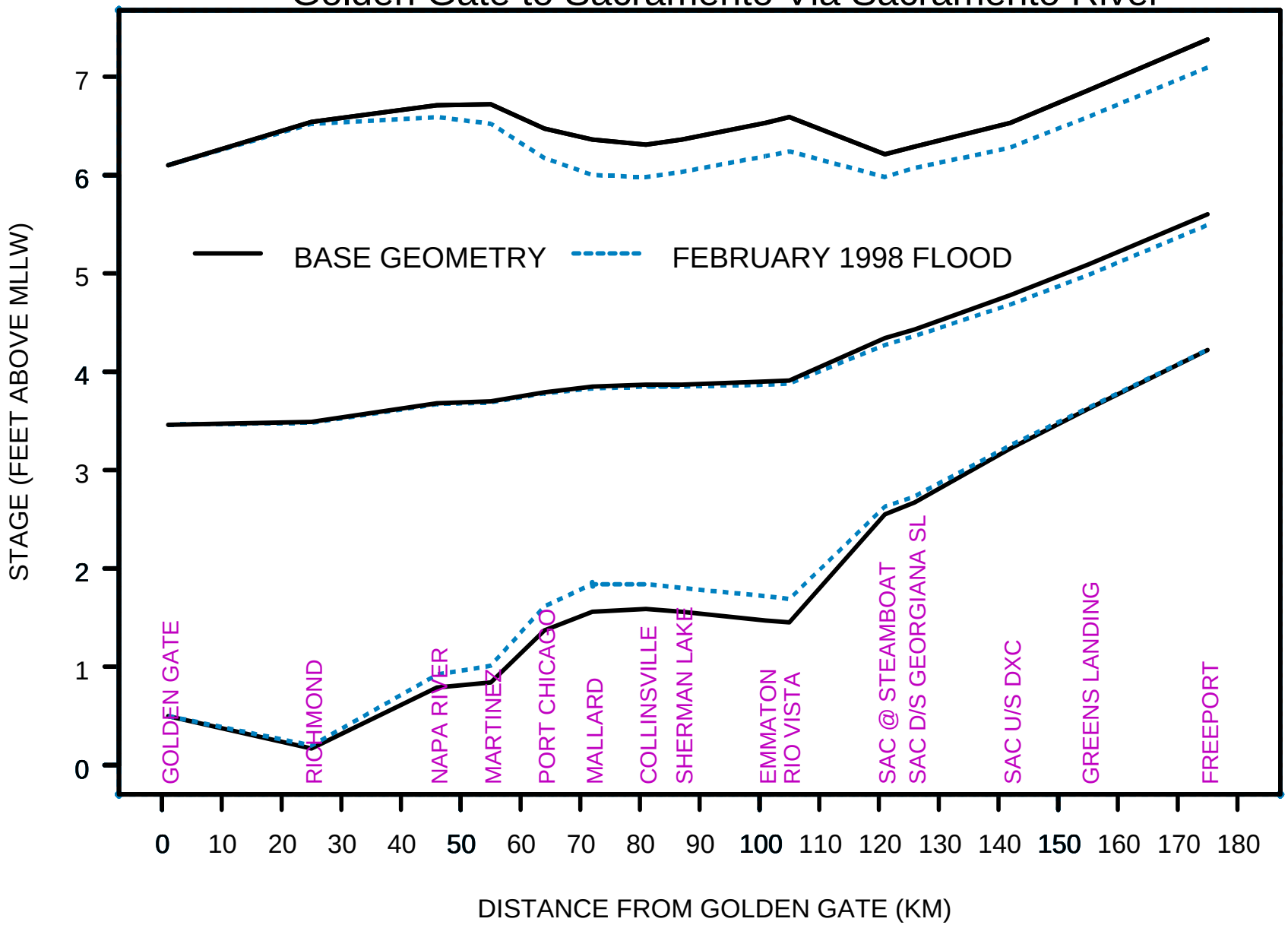
1) **Breached areas dissipate finite tidal energy and reduce tidal range everywhere. This reduces tidal excursion which is proportional to dispersion of salt. *Salinity tends to be reduced.***

2) Asymmetry between tidal flows inside and outside levee breaches can “trap” salinity upstream.

Salinity tends to be increased.

28 Day Average Tidal Range

Golden Gate to Sacramento Via Sacramento River



Two *"competing"* mechanisms are at work (continued):

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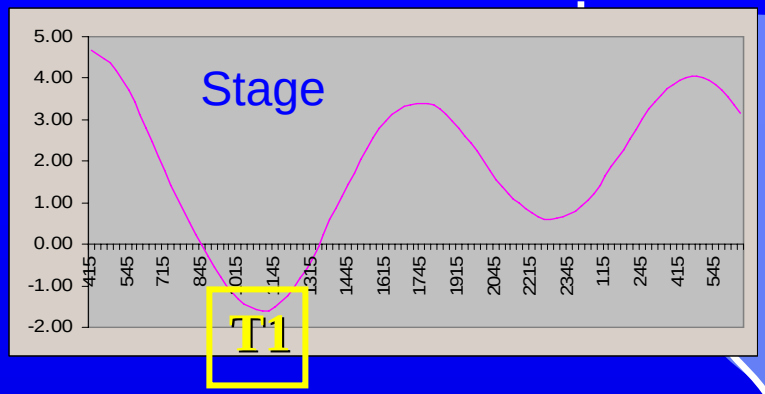


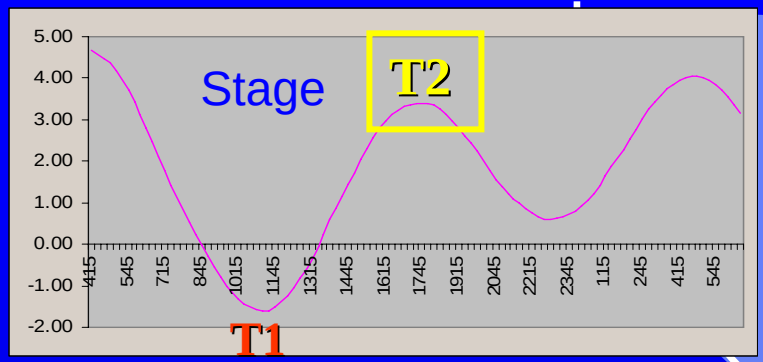
Tidal Trapping: Time 1 Low Slack Tide

Levee Breach Case

T1

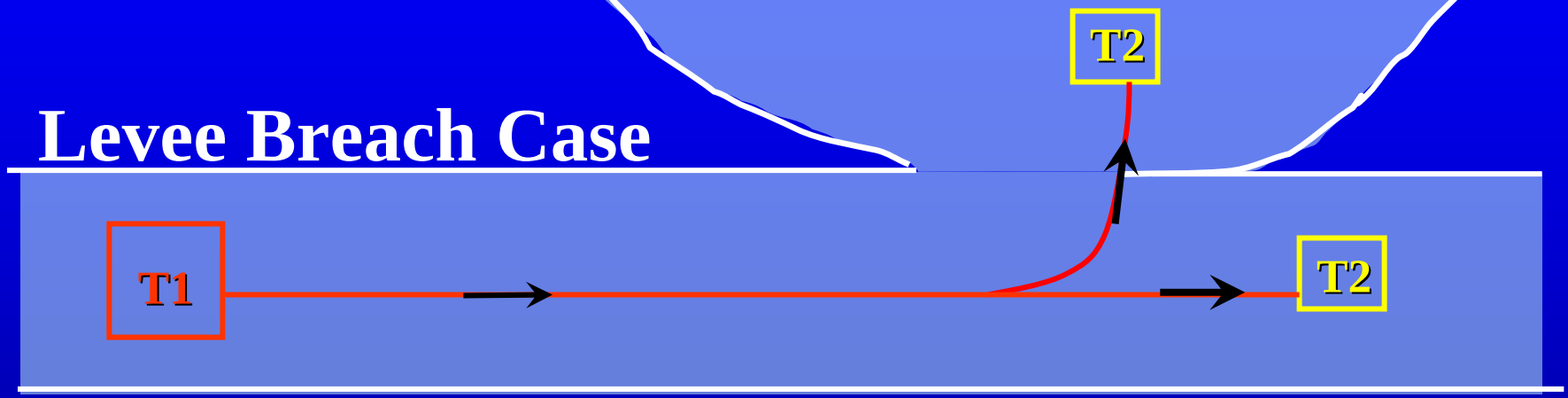
Base Case

T1

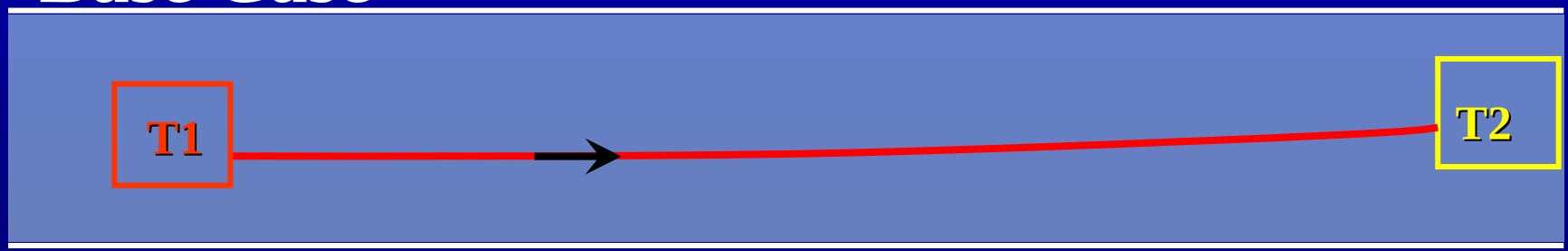


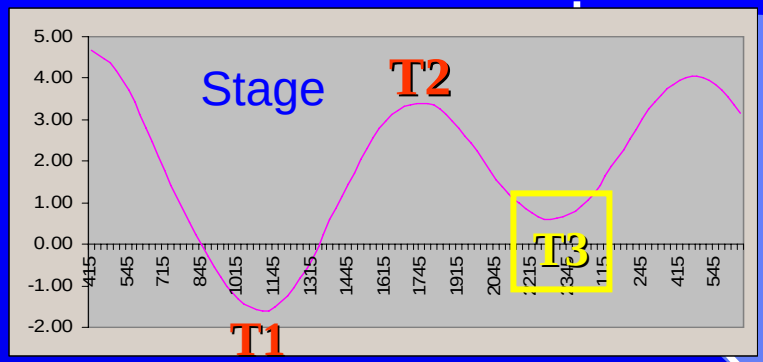
Tidal Trapping: Time 2 High Slack Tide

Levee Breach Case



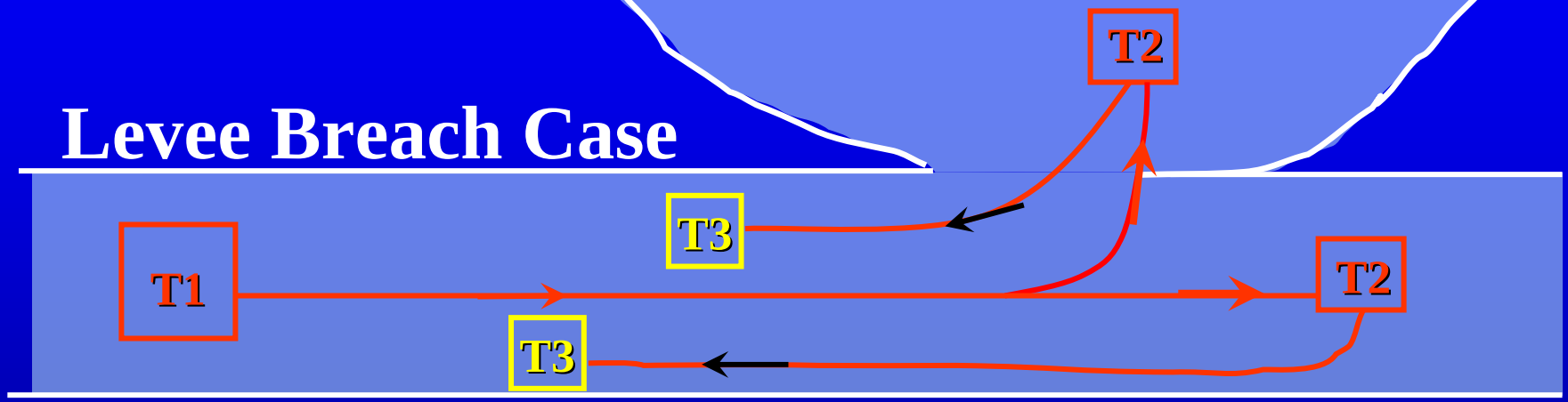
Base Case



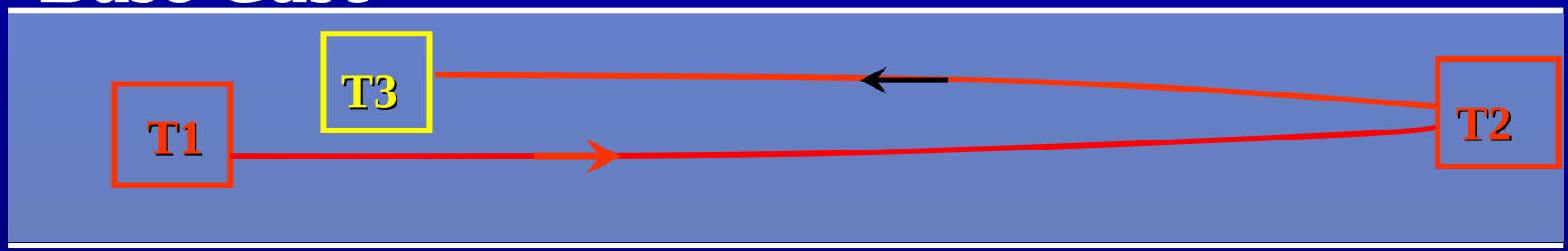


Tidal Trapping: Time 3 Low Slack Tide

Levee Breach Case



Base Case



Findings

Suisun Marsh levee breaches *in general:*

- Unrepaired breaches -> higher Delta salinity
- Maintained breaches -> lower Delta salinity
- Salinity response is sensitive to breach size and location.
- Tidal range is always reduced.

Additional Findings

- Regional salinity increases when breaches are adjacent to deep, energetic channels.
- Interior Marsh breaches tend to produce widespread salinity decrease (with local increases).

Conclusions

- Based on this study:
  - Maintenance of Suisun Bay levees are critical for Delta water quality control *(and averting **disaster**).*
  - ***Opportunities*** exist for win-win restoration projects in the Suisun Marsh.

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Questions for Biologists

Are Tidal Marsh and SWH restoration opportunities enhanced in the Suisun Marsh?

- The Suisun Marsh is proximate to X2.
- Food web benefit of organic carbon production.
- Methylation and bioavailability of mercury *may* be less of a problem.
- The Marsh exhibits greater salinity variability.
- Native fish are relatively more abundant in the Marsh.

Van Sickle Island

BREACH versus CHANNEL FLOW ASYMMETRY